The invention in which an exclusive right is claimed is defined by the following:

1. A stacked plate reactor for reacting one chemical reactant with at least one other chemical reactant to form a chemical product, said stacked plate reactor comprising a plurality of simple plates, stacked in layers, each simple plate having at least one opening that extends therethrough, an opening in each simple plate overlapping at least one other opening in an adjacent simple plate, said simple plates, when thus stacked in layers, defining:

(a) a fluid path for each different chemical reactant;

(b) a fluid path for a chemical product;

(c) a fluid path for a heat transfer medium;

(d) a heat exchanger coupled in fluid communication with the fluid path for the heat transfer medium; and

(e) means for manipulating a flow of fluid in said stacked plate reactor to achieve a desired result.

2. The stacked plate reactor of Claim 1, further comprising at least one additional plate having no openings, said at least one additional plate being disposed to seal at least one of a top, a bottom, and a side of the stacked plate reactor.

3. The stacked plate reactor of Claim 1, wherein said means for manipulating a flow of fluid comprises means for providing internal parallelization of fluid flow through the stacked plate reactor, thereby increasing a quantity of chemical product that can be produced by said stacked plate reactor per unit time.

4. The stacked plate reactor of Claim 3, wherein said means for providing internal parallelization comprises a plurality of simple plates that define individual reaction units, each reaction unit including:

(a) a mixing and reaction chamber;

(b) a reactant fluid path for each reactant, each reactant fluid path being in fluid communication with said mixing and reaction chamber; and

(c) a bypass fluid path for each reactant, each bypass fluid path being in fluid communication with a different individual reaction unit, such that a reactant flowing in a bypass fluid path in a reaction unit does not also flow into a mixing and reaction chamber in said reaction unit.

5. The stacked plate reactor of Claim 4, wherein a plurality of individual reaction units are irreversibly joined together to form a reactor stack.

6. The stacked plate reactor of Claim 5, wherein a plurality of individual reactor stacks are reversibly joined together to form a chemical plant.

7. The stacked plate reactor of Claim 1, wherein said means for manipulating a flow of fluid comprises means for equalizing a residence time distribution within said stacked plate reactor.

8. The stacked plate reactor of Claim 7, wherein said means for equalizing the residence time distribution within said stacked plate reactor comprises a bifurcated opening in at least one of the plurality of simple plates, said bifurcated opening defining at least one of a reactant fluid path and a product fluid path.

9. The stacked plate reactor of Claim 7, wherein said means for equalizing a residence time distribution within said stacked plate reactor comprises an array of openings in at least one of the plurality of simple plates, said array of openings defining at least one of a plurality of reactant fluid paths, a plurality of mixing and reaction chambers, and a plurality of product fluid paths, said array of openings comprising openings having widths that vary across said array.

10. The stacked plate reactor of Claim 9, wherein a widest opening in said array is disposed furthest from an opening that enables a fluid to exit from said array.

11. The stacked plate reactor of Claim 9, wherein a widest opening in said array is disposed closest to an opening that enables a fluid to exit from said array.

12. The stacked plate reactor of Claim 10, wherein the widths of said array vary as a function of the change of the viscosity of a fluid to be introduced into said array.

13. A stacked plate reactor for reacting one chemical reactant with at least one other chemical reactant to form a chemical product, said stacked plate reactor comprising a plurality of simple plates, stacked in layers, each simple plate having at least one opening that extends therethrough, an opening in each simple plate overlapping at least one other opening in an adjacent simple plate, thereby forming:

(a) a fluid path for each different chemical reactant;

(b) a processing volume in fluid communication with each fluid path for each different chemical reactant;

(c) a fluid path for a chemical product in fluid communication with the processing volume;

(d) a fluid path for a heat transfer medium;

(e) a heat exchanger in fluid communication with the fluid path for the heat transfer medium and disposed so as to moderate a temperature of at least one of a chemical reactant, the processing volume, and the fluid path for the chemical product; and

(f) a means for enhancing at least one of:

(i) a quantity of chemical product that is produced by said stacked plate reactor per unit time; and

(ii) a quality of a chemical product that is produced by said stacked plate reactor.

14. The stacked plate reactor of Claim 13, further comprising at least one additional plate having no openings, said at least one additional plate being disposed to seal at least one of a top, a bottom, and a side of the stacked plate reactor.

15. The stacked plate reactor of Claim 13, wherein said simple plates comprise a material selected from the group consisting of crystalline wafers, ceramics, glasses, polymers, composite materials, and metals.

16. The stacked plate reactor of Claim 13, wherein said simple plates are fabricated from a stainless steel.

17. The stacked plate reactor of Claim 13, wherein said means for enhancing comprises means for providing internally parallel processing volumes, thereby enhancing the quantity of chemical product produced in said stacked plate reactor.

18. The stacked plate reactor of Claim 17, wherein the plurality of simple plates are organized into a plurality of serially connected reaction units, and wherein the means for providing internal parallelization comprise a plurality of openings in the simple plates that are organized into the reaction units, said plurality of opening, when aligned forming for each reaction unit:

(a) a processing volume;

(b) a processing volume fluid path for each reactant, each processing volume fluid path being in fluid communication with the processing volume;

(c) a product fluid path for a product produced in said processing volume, said product fluid path being in fluid communication with a different product fluid path in a different reaction unit; and

(d) a bypass fluid path for each reactant in fluid communication with any subsequent reaction unit, but not in fluid communication with the processing volume of a current reaction unit.

19. The stacked plate reactor of Claim 18, wherein each serially-connected reaction unit comprises:

(a) a first heat exchanger for modifying a temperature of a first chemical reactant; and

(b) a second heat exchanger for modifying a temperature of at least one of a second chemical reactant and of the processing volume.

20. The stacked plate reactor of Claim 19, wherein a heat exchanger is shared between adjacent serially-connected reaction units.

21. The stacked plate reactor of Claim 18, wherein the processing volume of each reaction unit is sandwiched between a pair of heat exchangers.

22. The stacked plate reactor of Claim 18, wherein a plurality of individual reaction units are irreversibly joined together to form a reactor stack.

23. The stacked plate reactor of Claim 22, wherein a plurality of individual reactor stacks are reversibly joined together to form a chemical plant.

24. The stacked plate reactor of Claim 18, wherein each subsequent serially-connected reaction unit is coupled to a subsequent reaction unit such that a first simple plate in a subsequent reaction unit is stacked adjacent to a last simple plate of a preceding reaction unit.

25. The stacked plate reactor of Claim 18, wherein the processing volume fluid paths for each reactant are disposed so that laminated flow is established between each reactant flowing in the processing volume.

26. The stacked plate reactor of Claim 18, wherein each subsequent serially-connected reaction unit is coupled to a subsequent reaction unit such that a first simple plate of a subsequent reaction unit also represents the last simple plate of a preceding reaction unit.

27. The stacked plate reactor of Claim 18, wherein the processing volume fluid paths for each reactant are disposed so that laminated flow is established between each reactant flowing in the processing volume.

28. The stacked plate reactor of Claim 18, wherein the processing volume comprises a plurality of individual mixing and reaction chambers.

29. The stacked plate reactor of Claim 18, wherein aligned openings in the simple plates form at least two reaction units, and wherein said means for providing internal parallelization comprise:

(a) a plurality of openings in the simple plates that comprise a first reaction unit, said plurality of openings being aligned to form, for each different chemical reactant:

(i) a reaction unit fluid path in fluid communication with a processing volume in said first reaction unit; and

(ii) a bypass fluid path that bypasses the processing volume in the first reaction unit, and is in fluid communication with any subsequent reaction unit; and

(b) a plurality of openings in the simple plates that comprise a last reaction unit, said plurality of openings being aligned to form, for each different chemical reactant, a reaction unit fluid path in fluid communication with a processing volume in said last reaction unit.

30. The stacked plate reactor of Claim 18, wherein said means for providing internal parallelization comprise a plurality of openings in said simple plates that when aligned, form:

(a) a single fluid inlet for each chemical reactant;

(b) a reactor fluid path for each chemical reactant, each reactor fluid path being in fluid communication with a processing volume in a first reaction unit;

(c) a bypass fluid path for each chemical reactant, each bypass fluid path bypassing the processing volume in the first reaction unit, and being in fluid communication with any subsequent reaction unit; and

(d) a single fluid outlet for the chemical product.

31. The stacked plate reactor of Claim 13, wherein said means for enhancing comprises a plurality of fluid channels in the heat exchanger that extend

substantially orthogonal to a plurality of fluid channels for directing a flow of at least one of a chemical reactant and a chemical product, where a temperature of said one of the chemical product and the chemical reactant is modified by heat transfer relative to the heat transfer medium that is flowing through the heat exchanger, thereby enhancing the quality of a product that is produced in the stacked plate reactor.

32. The stacked plate reactor of Claim 13, wherein said means for enhancing comprises fluid paths for each chemical reactant that is disposed so as to establish laminated flow in the processing volume, thereby enhancing the quality of the product that is produced in the stacked plate reactor.

33. The stacked plate reactor of Claim 13, wherein said means for enhancing comprises a processing volume simple plate disposed immediately adjacent to a simple plate having an opening defining the processing volume, said processing volume simple plate having a first opening associated with a first fluid path for a first chemical reagent, and a second opening associated with a second fluid path for a second chemical reagent, said first opening and said second opening being aligned with the opening defining the processing volume, such that a first reactant is caused to enter the processing volume, followed by a second reactant in a manner that establishes laminated flow of the first reactant and the second reactant in the processing volume, thereby enhancing the quality of a product that is produced in the stacked plate reactor.

34. The stacked plate reactor of Claim 13, wherein said means for enhancing comprises means for equalizing a residence time distribution of a fluid flowing within said reactor.

35. The stacked plate reactor of Claim 34, wherein said means for equalizing a residence time distribution within said reactor comprises an opening in at least one simple plate, said opening having a bifurcated shape, the bifurcated shape causing a fluid to split into a bifurcated fluid channel having a plurality of branches.

36. The stacked plate reactor of Claim 35, wherein each chemical reactant flows through a different bifurcated fluid channel, a stem of each bifurcated fluid channel being in fluid communication with a respective chemical reactant inlet, and the branches of each bifurcated fluid channel being in fluid communication with the processing volume.

37. The stacked plate reactor of Claim 35, wherein the processing volume comprises a plurality of mixing and reaction chambers, such that one branch from each of the bifurcated fluid channels is in fluid communication with each of the plurality of mixing and reaction chambers.

38. The stacked plate reactor of Claim 37, wherein the processing volume comprises a plurality of mixing and reaction chambers, further comprising a bifurcated product collection channel having a plurality of branches, a stem of the bifurcated product collection channel being in fluid communication with a chemical product outlet, and each branch of the bifurcated product collection channel being in fluid communication with a different one of the plurality of mixing and reaction chambers.

39. The stacked plate reactor of Claim 37, wherein a bifurcated fluid channel is included for each chemical reactant and a bifurcated product collection channel is included to collect a product.

40. The stacked plate reactor of Claim 37, wherein the heat exchanger comprises a first heat exchanger for modifying a temperature of a first chemical reactant, further comprising:

(a) a second heat exchanger for modifying a temperature of at least one of a second chemical reactants and the processing volume;

(b) a third heat exchanger for modifying a temperature of at least one of the processing volumes and a product collection channel; and

(c) a fourth heat exchanger for modifying a temperature of the product collection channel.

41. The stacked plate reactor of Claim 34, wherein said means for equalizing a residence time distribution within said reactor comprises a bifurcated fluid path having a plurality of branches.

42. The stacked plate reactor of Claim 41, wherein said bifurcated fluid path is achieved by a bifurcated shaped opening in at least one simple plate, such that the bifurcated fluid path is oriented substantially parallel to an orientation of the simple plates.

43. The stacked plate reactor of Claim 41, wherein said bifurcated fluid path is achieved by aligning openings in a plurality of adjacent simple plates, such that the bifurcated fluid path is oriented substantially orthogonally to an orientation of the simple plates.

44. The stacked plate reactor of Claim 41, wherein said bifurcated fluid path is achieved by a combination of a bifurcated shaped opening in at least one simple plate, and by aligning openings in a plurality of adjacent simple plates.

45. The stacked plate reactor of Claim 37, further comprising:

(a) a first outer simple plate having openings defining a fluid inlet for each different chemical reactant, a fluid inlet for the heat transfer medium, and a fluid outlet for the heat transfer medium; and

(b) a second outer simple plate having an opening defining the chemical product outlet.

46. The stacked plate reactor of Claim 37, wherein the processing volume comprises a plurality of parallel mixing and reaction chambers that are disposed between a pair of heat exchangers.

47. The stacked plate reactor of Claim 34, wherein said means for equalizing a residence time distribution of a fluid comprises a plurality of openings having different widths disposed in at least one simple plate, the different widths being selected to provide a substantially even flow equipartition for a fluid flowing through a plurality of different width fluid channels defined by the plurality of openings having different widths.

48. The stacked plate reactor of Claim 47, wherein each of the plurality of openings having different widths are disposed in a parallel array, said openings being ordered so as to decrease in size from a widest opening to a narrowest opening and defining a parallel array of the different width fluid channels.

49. The stacked plate reactor of Claim 48, wherein a widest fluid channel in said parallel array of different width fluid channels is disposed closer to a fluid inlet opening than any other fluid channel in said parallel array.

50. The stacked plate reactor of Claim 48, wherein a widest fluid channel in said parallel array of different width fluid channels is disposed further to a fluid outlet opening than any other fluid channel in said parallel array.[1]

51. The stacked plate reactor of Claim 48, wherein each chemical reactant is directed into a different parallel array of different width fluid channels.

52. The stacked plate reactor of Claim 48, wherein the processing volume comprises a parallel array of different width fluid channels, each different width fluid channel comprising an individual mixing and reaction chamber.

53. The stacked plate reactor of Claim 48, wherein the widths of said fluid channels in the array are determined as a function of the viscosity change of a fluid to be introduced into said array.

54. The stacked plate reactor of Claim 48, wherein the heat exchanger comprises a first heat exchanger for modifying a temperature of a first chemical reactant, and a second heat exchanger for modifying a temperature of at least one of a second chemical reactant and the processing volume.

55. The stacked plate reactor of Claim 48, further comprising one of a top simple plate, a bottom simple plate, and a side simple plate, said one having openings defining a fluid inlet for each different chemical reactant, a fluid inlet for the heat transfer medium, a fluid outlet for the heat transfer medium, and a chemical product outlet.

56. The stacked plate reactor of Claim 13, wherein said means for enhancing comprises a plurality of elongate openings in a simple plate that define the heat exchanger, the simple plate being no thicker than about two millimeters, thereby enhancing an efficiency with which the heat exchanger functions to increase a quality of a product produced in said reactor.

57. The stacked plate reactor of Claim 13, further comprising at least one plug having a size and shape corresponding to a non-required fluid path defined by aligned openings in said plurality of simple plates, said at least one plug sealing the aligned openings defining said non-required fluid path, thereby eliminating a dead volume in said stacked plate reactor.

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58. The stacked plate reactor of Claim 13, wherein the stack of simple plates are removably held together with an applied compressive force.

59. The stacked plate reactor of Claim 13, further comprising a housing that applies a compressive force against a top simple plate and a bottom simple plate.

60. The stacked plate reactor of Claim 13, wherein a mean surface roughness of the simple plates is less than about two micrometers, and the simple plates are substantially free of scratches.

61. The stacked plate reactor of Claim 13, wherein the simple plates are held together with an applied compressive force, developing a pressure of at least about 300 Newtons per square millimeter.

62. A simple plate chemical reactor for processing at least two reactants to form a desired chemical product, comprising:

(a) a first outer simple plate comprising a fluid inlet for each different chemical reactant, a fluid outlet for a chemical product, a fluid inlet for a heat transfer medium, and a fluid outlet for a heat transfer medium;

(b) a plurality of internal simple plates defining a plurality of serially-connected reaction units, each reaction unit being in fluid communication with said first outer simple plate, each reaction unit comprising a stack of simple plates, stacked in layers, each simple plate having at least one opening that extends therethrough, an opening in each simple plate overlapping at least one other opening in an adjacent simple plate, thereby forming:

(i) a plurality of heat exchangers for modifying a temperature of at least one of a chemical reactant and a chemical product;

(ii) at least one mixing and reaction chamber; and

(iii) a bypass fluid path for each reactant, such that a portion of each reactant is diverted from the at least one mixing and reaction chamber of a present reaction unit, and is thus available to be directed to at least one mixing and reaction chamber of a subsequent reaction unit; and

(c) a second outer plate disposed such that the plurality of internal simple plates are stacked between the first outer, simple plate and the second outer plate.

63. A simple plate chemical reactor for processing at least two reactants to form a desired chemical product, comprising:

(a) a first outer simple plate comprising a fluid inlet for each different chemical reactant, a fluid outlet for a chemical product, a fluid inlet for a heat transfer medium, and a fluid outlet for a heat transfer medium;

(b) a plurality of internal simple plates defining a plurality of serially-connected reaction units, each reaction unit being in fluid communication with said first simple plate, each reaction unit comprising a stack of simple plates, stacked in layers, each simple plate having at least one opening that extends therethrough, an opening in each simple plate overlapping at least one other opening in an adjacent simple plate, thereby forming:

(i) a plurality of heat exchangers for modifying a temperature of at least one of a chemical reactant and a chemical product;

(ii) a processing volume;

(iii) a processing fluid path for each reactant, each processing fluid path being in fluid communication with a corresponding reactant fluid inlet and the processing volume;

(iv) a product collection fluid path in fluid communication with the product outlet and the processing volume;

(v) a reactant bypass fluid path for each reactant, each reactant bypass fluid path bypassing the processing volume of a present reaction unit, and being in fluid communication with a different reaction unit; and

(vi) a product bypass fluid path for the reaction product, each product bypass fluid path bypassing the processing volume of a present reaction unit, and being in fluid communication with a different reaction unit; and

(c) a second outer plate disposed such that the plurality of internal simple plates are stacked between the first outer; simple plate and the second outer plate.

64. The chemical reactor of Claim 63, wherein the simple plates having different configurations are stacked to fabricate the reactor.

65. The chemical reactor of Claim 63, wherein said second outer plate and said first outer simple plate are identical in configuration, further comprising a plurality of plugs to seal each opening in said second outer plate.

66. The chemical reactor of Claim 65, further comprising a second simple plate disposed between said first outer simple plate and a first reaction unit, said second simple plate having an opening associated with a product fluid passage.

67. The stacked plate reactor of Claim 63, further comprising means for enhancing a fluid distribution within said reactor.

68. The chemical reactor of Claim 67, wherein said means for enhancing the fluid distribution within the reactor comprises an opening having a bifurcated shape formed in at least one simple plate, for distributing a fluid into a bifurcated channel having a plurality of branches.

69. The chemical reactor of Claim 68, further comprising a bifurcated fluid channel for each chemical reactant, a stem of each bifurcated fluid channel being in fluid communication with a respective chemical reactant inlet, and branches of each bifurcated fluid channel being in fluid communication with the processing volume.

70. The chemical reactor of Claim 68, further comprising a bifurcated product collection channel having a plurality of branches, a stem of the bifurcated product collection channel being in fluid communication with the chemical product outlet, and branches of said bifurcated product collection channel being in fluid communication with the processing volume.

71. The chemical reactor of Claim 68, wherein each reaction unit includes a bifurcated fluid channel and a bifurcated product collection channel.

72. The chemical reactor of Claim 67, wherein said means for enhancing a fluid distribution within the reactor comprises at least one simple plate in which a plurality of openings having different widths are formed, said different widths being selected to provide a substantially even flow equipartition for a fluid flowing in a plurality of different width fluid channels defined by said plurality of openings.

73. The chemical reactor of Claim 72, wherein each of the plurality of openings having different widths are disposed in a parallel array, ordered in increasing widths from a narrowest opening to a widest opening, thereby defining a parallel array of different width fluid channels.

74. The chemical reactor of Claim 73, wherein an incremental increase in the widths of the fluid channels of said array is a function of the viscosity change of a fluid that will flow through the different width fluid channels of said array, so as to equalize a residence time distribution of the fluid within said array.

75. The chemical reactor of Claim 67, wherein said means for enhancing a fluid distribution within the reactor comprises at least one simple plate in which a plurality of openings having different lengths are formed, said different lengths being selected to provide a substantially equivalent even flow equipartition for a fluid flowing in a plurality of different width fluid channels defined by said plurality of openings.

76. A simple plate chemical reactor for processing at least two reactants to form a desired chemical product, comprising:

(a) a first outer simple plate and a second outer simple plate, said first and second outer plates together including a fluid inlet for each chemical reactant, a product outlet, a fluid inlet for a heat transfer medium, and a fluid outlet for the heat transfer medium;

(b) a plurality of simple plates disposed between the first and the second outer simple plates, each simple plate having at least one opening that extends therethrough, an opening in each simple plate overlapping at least one other opening in an adjacent simple plate, thereby forming:

(i) a plurality of heat exchangers for modifying a temperature of at least one of a chemical reactant and a chemical product;

(ii) at least one fluid path for each chemical reactant;

(iii) at least one mixing and reaction channel; and

(iv) means for manipulating a flow of fluid in said stacked plate reactor to achieve a desired result.

77. The simple plate chemical reactor of Claim 76, wherein the product outlet is disposed in said first outer simple plate.

78. The simple plate chemical reactor of Claim 76, wherein the product outlet is disposed in said second outer plate.

79. The simple plate chemical reactor of Claim 76, wherein said means for manipulating a flow of fluid in said stacked plate reactor to achieve a desired result comprise a plurality of openings in a simple plate defining a heat exchanger, and a plurality of openings in an adjacent simple plate defining at least one of a fluid path for a chemical reactant and a mixing and reaction channel, such that the plurality of openings in the simple plate defining the heat exchanger are substantially orthogonal to the plurality of openings in said adjacent simple plate.

80. The simple plate chemical reactor of Claim 76, wherein said means for manipulating a flow of fluid in said stacked plate reactor to achieve a desired result comprises means for enabling diffusion mixing to occur between at least a first reactant and a second reactant within the simple plate chemical reactor.

81. The simple plate chemical reactor of Claim 80, wherein said means for enabling diffusion mixing to occur comprises an upper reaction channel simple plate disposed adjacent to a simple plate having an opening defining a mixing and reaction channel, said upper reaction channel simple plate having a first opening associated with a first fluid path for a first chemical reagent, and a second opening associated with a second fluid path for a second chemical reagent, said first opening and said second opening being aligned with the opening defining a mixing and reaction channel, such that a first reactant is caused to enter the mixing and reaction channel first, followed by a second reactant, establishing laminated flow between the first reactant and the second reactant in the mixing and reactant channel.

82. The simple plate chemical reactor of Claim 76, wherein said means for manipulating a flow of fluid in said stacked plate reactor to achieve a desired result comprises means for enhancing a fluid distribution within the reactor.

83. The simple plate chemical reactor of Claim 82, wherein said means for enhancing a fluid distribution within the reactor comprises an opening in at least one simple plate, said opening having a bifurcated shape for a fluid flowing in at least one bifurcated fluid channel defined by the opening having said bifurcated shape.

84. The simple plate chemical reactor of Claim 83, wherein a bifurcated fluid channel having a stem and a plurality of branches is included for each chemical reactant, the stem of each bifurcated fluid channel being in fluid communication with a respective chemical reactant inlet, and branches of each bifurcated fluid channel being in fluid communication with a mixing and reaction channel.

85. The simple plate chemical reactor of Claim 83, wherein the at least one bifurcated fluid channel comprises a bifurcated product collection channel, the stem of the bifurcated product collection channel being in fluid communication with the product outlet, and the branches of said bifurcated product collection channel being in fluid communication with a mixing and reaction channel.

86. The simple plate chemical reactor of Claim 83, wherein a bifurcated fluid channel is included for each chemical reactant and one bifurcated fluid channel comprises a bifurcated product collection channel.

87. The simple plate chemical reactor of Claim 83, wherein said plurality of heat exchangers comprise:

(a) a first heat exchanger for modifying a temperature of a first chemical reactant;

(b) a second heat exchanger for modifying a temperature of at least one of a second chemical reactant and a mixing and reaction channel;

(c) a third heat exchanger for modifying a temperature of at least one of said mixing and reaction channel and a product collection channel; and

(d) a fourth heat exchanger for modifying a temperature of said product collection channel.

88. The simple plate chemical reactor of Claim 82, wherein said means for enhancing a fluid distribution within the reactor comprises a plurality of openings having different widths formed in at least one simple plate, said different widths having been selected to provide a substantially even flow equipartition for a fluid flowing in a plurality of fluid channels defined by the plurality of openings having different widths.

89. The simple plate chemical reactor of Claim 88, wherein each of the plurality of openings having different widths in a single simple plate comprise a parallel array, ordered from a narrowest opening, incrementally increasing to a widest opening, defining a parallel array of the plurality of fluid channels having different widths.

90. The simple plate chemical reactor of Claim 89, wherein a widest fluid channel in said parallel array of fluid channels is disposed further to a fluid outlet opening than any other fluid channel in said parallel array.

91. The simple plate chemical reactor of Claim 90, wherein each chemical reactant is directed into a different parallel array of fluid channels having different widths, each different parallel array of fluid channels being disposed in a different simple plate.

92. The simple plate chemical reactor of Claim 90, wherein the parallel array of fluid channels having different widths comprises a mixing and reaction channel.

93. The simple plate chemical reactor of Claim 82, wherein said means for enhancing a fluid distribution within the reactor comprises a plurality of openings having different lengths formed in at least one simple plate, said different lengths having been selected to provide a even flow equipartition for a fluid flowing in a plurality of fluid channels defined by the plurality of openings having different lengths.

94. The simple plate chemical reactor of Claim 76, wherein said means for manipulating a flow of fluid in said simple plate chemical reactor to achieve a desired result comprises means for providing internal parallelization of said simple plate chemical reactor, to achieve increased throughput.

95. The simple plate chemical reactor of Claim 94, wherein contiguous sets of the simple plates comprise a plurality of serially-connected reaction units, and wherein said means for providing internal parallelization comprise a plurality of openings in different contiguous sets of the simple plates, which when aligned form, for each one of said serially-connected reaction units:

(a) a reaction unit fluid path in fluid communication with processing volumes in that reaction unit; and

(b) a bypass fluid path that bypasses all processing volumes in that reaction unit, and is in fluid communication with any subsequent reaction unit.

96. The simple plate chemical reactor of Claim 95, wherein each serially-connected reaction unit comprises:

(a) a first heat exchanger for modifying a temperature of a first chemical reactant;

(b) a second heat exchanger for modifying a temperature of at least one of a second chemical reactant and a mixing and reaction channel, said mixing and reaction channel being operative to:

(i) establish a laminated flow between a first chemical reactant and a second chemical reactant;

(ii) mix the first chemical reactant and the second chemical reactant together via diffusion mixing; and

(iii) provide sufficient residence time for initiating a chemical reaction between the first chemical reactant and the second chemical reactant; and

(c) a third heat exchanger for modifying a temperature of said mixing and reaction channel.

97. The simple plate chemical reactor of Claim 96, wherein the first heat exchanger of each serially-connected reaction unit disposed downstream of a different serially-connected reaction unit also comprises the third heat exchanger of the reaction unit disposed immediately upstream.

98. The simple plate chemical reactor of Claim 95, wherein a plurality of said serially-connected reaction units are irreversibly joined together to form a reactor stack.

99. The simple plate chemical reactor of Claim 98 wherein a plurality of individual reactor stacks are reversibly joined together to form a chemical plant.

100. A method for fabricating a chemical reactor incorporating at least one means for enhancing at least one of a quantity of chemical products produced by said chemical reactor per unit time, and a quality of a chemical product produced by said chemical reactor, said chemical reactor combining at least two chemical reactants to produce the chemical product, comprising the steps of:

(a) providing a plurality of simple plates configured to define at least one reactor unit, said plurality of simple plates including:

(i) a first outer simple plate and a second outer simple plate, at least one of said first and second outer simple plates including a plurality of openings, said plurality of openings defining at least two chemical reactant inlets, a product outlet, a heat transfer medium inlet, and a heat transfer medium outlet;

(ii) a set of simple plates for each reactor unit that are adapted to be disposed between the first and the second outer simple plates, each simple plate of the set having at least one opening, each reactor unit comprising at least two heat exchangers and at least one mixing and reaction channel, a mixing and reaction channel being disposed between at least two heat exchangers in heat transfer communication therewith, and fluid paths for each chemical reactant, the chemical product, and heat transfer medium;

(b) stacking the first outer simple plate and a first set of simple plates defining a first reactor unit such that openings and solid portions of adjacent simple plates cooperate to form:

(i) chemical reactant fluid paths, the heat transfer medium fluid paths, said at least two heat exchangers, said at least one reaction and mixing channel, and a product fluid path, said chemical reactant fluid paths and said heat transfer medium fluid being in fluid communication with respective chemical reactant inlets and the heat transfer medium inlet; and

(ii) means for enhancing at least one of the quantity of the chemical product produced per unit time, and the quality of the chemical product produced by said stacked plate reactor;

(c) for each additional reactor unit to be included, stacking each previous set of the simple plates on a successive set of simple plates, such that for each successive set of simple plates, openings and solid portions in adjacent simple plates cooperate to form the chemical reactant fluid paths, the heat transfer medium fluid paths, said at least two heat exchangers, said at least one reaction and mixing channel, and said product fluid path, said chemical reactant fluid paths and said heat transfer medium fluid being in fluid communication with respective reagent inlets, each reactor unit including the means for manipulating the flow of fluid to achieve the desired result;

(d) adding the second outer simple plate to a bottom of a last reactor unit; and

(e) securing together said first and second outer simple plates and said plurality of simple plates in the stack that is thus formed.

101. The method for Claim 100, wherein said means for enhancing at least one of the quantity of chemical product produced per unit time, and the quality of the chemical product produced by said chemical reactor comprises at least one of the steps of:

(a) equalizing a residence time of a fluid flowing through a plurality of parallel fluid channels within the chemical reactor, said fluid comprising one of a reactant, and the chemical product;

(b) directing the heat transfer medium through a plurality of heat transfer medium openings comprising a heat exchanger in a direction orthogonal to a flow of one of a reactant and a product that is being thermally conditioned by the heat transfer medium; and

(c) internally parallelizing the flow or reactants through the chemical reactor to produce the chemical product in the plurality of reactor units.

102. A method for fabricating a stacked plate chemical reactor capable of *n*-fold internal parallelization, said chemical reactor combining at least two chemical reactants to produce a desired chemical product, where *n* is determined as a function of a desired rate at which the chemical product is to be produced, comprising the steps of:

(a) determining a value for *n*, as a function of the desired rate at which the chemical product is to be produced;

(b) providing a plurality of simple plates, said plurality of simple plates including *n* sets of simple plates, each set of simple plates defining a reactor unit, each simple plate including at least one opening, each reactor unit including at least two heat exchangers, a mixing and reaction channel disposed between at least two heat exchangers, and fluid paths for each chemical reactant, the chemical product, and heat transfer medium;

(c) stacking the sets of simple plates defining the *n* reactor units such that openings and solid portions in adjacent simple plates cooperate to form chemical reactant fluid paths, heat transfer medium fluid paths, heat exchangers, the reaction and mixing channels, and product fluid paths, said chemical reactant fluid paths, heat transfer medium fluid paths, and product fluid paths being in fluid communication with respective inlets and outlets of the chemical reactor; and

(d) securing said plurality of simple plates in the stack.

103. The method of Claim 102, wherein each of the plurality of simple plates includes an index feature, and the step of stacking the plurality of simple plates further includes the step of aligning the index features of the plurality of simple plates.

104. The method of Claim 102, wherein the step of securing comprises the steps of:

(a) for the set of simple plates comprising each reaction unit, irreversibly bonding the simple plates of the reaction unit together in a proper order, such that a first reaction unit includes one simple plate more than subsequent reaction units, since a last simple plate of a preceding reaction unit functions as a first simple plate in a subsequent reaction unit; and

(b) reversibly joining the reaction units together to form the stacked plate chemical reactor.

105. A method for enhancing a fluid distribution within a stacked plate reactor, comprising the steps of:

(a) providing a plurality of simple plates in each of which, at least one opening is formed, different openings in the plurality of simple plates comprising a fluid inlet for each different chemical reactant, a fluid outlet for a chemical product, a fluid inlet for a heat transfer medium, a fluid outlet for a heat transfer medium, at least one mixing and reaction channel, a plurality of heat exchangers, at least one fluid path for each different chemical reactant, at least one fluid path for a chemical product, at least one fluid path for a heat transfer medium, and means for enhancing a fluid distribution within said stacked plate reactor;

(b) forming the openings in a plurality of simple plates so that a shape and size of the openings enhances at least one of a heat transfer medium path, a chemical reactant fluid path, a mixing and reaction fluid path, and a chemical product collection fluid path;

(c) stacking the plurality of simple plates in a defined order, such that all required fluid inlets, fluid paths, fluid outlets, mixing and reaction channels, and heat exchangers are formed by overlapping openings and solid portions of adjacent simple plates; and

(d) securing said plurality of simple plates in the stack.

106. The method of Claim 105, wherein at least one opening in said simple plates is formed to have a bifurcated shape.

107. The method of Claim 105, wherein an array of parallel openings having different widths that defines parallel fluid channels are formed in at least one of the plurality of simple plates, said array of fluid channels being ordered from a narrowest opening to a widest opening.

108. The method of Claim 107, wherein the different widths are selected to provide a substantially even flow equipartition for a fluid flowing through the array of parallel fluid channels.

109. A method for enhancing a fluid distribution within a chemical reactor formed of stacked simple plates, comprising the steps of:

(a) for providing at least one simple plate in the stacked simple plates that includes an array of parallel openings having different widths that defines parallel fluid channels, said array of fluid channels being ordered from a narrowest opening to a widest opening

(b) determining a viscosity of a fluid that will be flowing through the parallel fluid channels; and

(c) determining the widths of the openings in said at least one simple plate as a function of the viscosity of said fluid, so that a flow equipartition of the fluid flowing through each of the parallel fluid channels is substantially even.

110. A method for performing a chemical reaction in an internally parallelized microreactor, wherein said internally parallelized microreactor comprises a plurality of internally parallel reaction chambers, the method comprising the steps of:

(a) introducing each reactant into said internally parallelized microreactor using only a single inlet port for each different reactant;

(b) diverting a portion of each reactant into a first reaction chamber, such that a quantity of the chemical product is produced;

(c) diverting a portion of each reactant into at least one additional reaction chamber, such that an additional quantity of the chemical product is produced, and such that the portion of each reactant diverted into said at least one additional reaction chamber is not introduced into any other reaction chamber; and

(d) collecting all of the chemical product produced using a single outlet port.